

**Thirty-Fourth
Annual Report**

o f t h e

**Board of Water and Power
Commissioners**

o f t h e

City of Los Angeles



Fiscal Year Ending June 30, 1935

Bureau of Water Works and Supply

H. A. VAN NORMAN
Chief Engineer and General Manager

July 1, 1935.

THE HONORABLE BOARD OF WATER
AND POWER COMMISSIONERS,
BUILDING.

Gentlemen:

The Thirty-fourth Annual Report of the Bureau of Water Works and Supply, covering the various activities of its several Divisions for the fiscal year ending June 30, 1935, is respectfully submitted herewith.

The reports by the various Division heads so completely set forth the various phases and subjects, that it is deemed unnecessary for me to do more than mention certain outstanding facts concerning the Bureau.

The Mono Basin Project was begun the first week in July, 1934. All buildings at West Portal and Shaft No. 1 are practically completed, and at Shaft No. 2 and East Portal buildings are 90% completed. These are modern camps, with all necessary provisions for the welfare of the employees. The dormitories for the men accommodate two men to a room, each dormitory being provided with heat, light, hot and cold water, wash room, toilets, and assembly room. Kitchens at the four camps on the tunnel project are equipped electrically for both cooking and refrigeration. Change houses are provided close to each working entrance, and are equipped with hot and cold showers, lockers, drying racks, etc. At West Portal camp, a modern field hospital has been completed, having a general ward accommodating 20 persons, and a smaller ward for four. The hospital is equipped with a modern surgery, as well as a therapy and X-ray laboratory. Two doctors with a corps of experienced nurses are in attendance. A fleet of three ambulances is held ready for instant service. All camps are connected by telephone with the West Portal medical headquarters. At the other three tunnel camps, first aid stations are maintained, with experienced male nurses on duty at all times. A school has been provided at West Portal for the children of the employees, the building and equipment being furnished by the Department, and the teacher and supervision being provided by Mono County.

At each of the camps, adequate sewer system has been installed, and sewage is disposed of through septic tanks and spreading grounds.

Tunnel excavation at West Portal began September 25, 1934. The total driven as of June 30, 1935, was 5,059 feet. One thousand eight hundred seventy-eight feet, or 37.1%, was supported.

The East Portal tunnel excavation began November 23, 1934. Total advance to June 30, 1935, was 3,790 feet, all of which was supported. This has been a very wet tunnel from the start. The flow of water has fluctuated from 900 gallons per minute, reaching a maximum of 1,700 gallons per minute on June 13, 1935, and as of June 30, 1935, being down to 1,370 gallons per minute.

The total length of Mono Craters tunnel is 59,812 feet. The total tunnel driven as of June 30, 1935, is 8,850 feet, or approximately 14.8% of the total length. Progress was a little slow during the early months of construction, owing to unavoidable delays in obtaining equipment, time required to organize efficient tunnel crews, and the severe climatic conditions. Progress for the last three months of the fiscal year was very good, as shown by the tabulation below. It will be noted that progress for the East Portal heading for June was slowed down, due mainly to the water encountered there.

TUNNEL EXCAVATION PROGRESS

Month	West Portal	East Portal
1935	Feet	Feet
April	1011.0	1219.0
May	1045.0	1205.5
June	1201.0	571.5

The sinking of Shaft No. 1 was started November 28, 1934. The total required depth to bottom of muck pocket is 955.0 feet, of which 539.0 feet, or 56.4%, had been sunk as of June 30, 1935. The shaft is timbered throughout. The first 40.0 feet from collar down is concrete lined.

The sinking of Shaft No. 2 started February 9, 1935. Total required depth to bottom of muck pocket is 359.0 feet, of which 340.5 feet, or 94.8%, had been sunk as of June 30, 1935. This shaft is timbered throughout. The first 70.0 feet from the collar down is concrete lined. This has been a wet shaft for practically its entire depth. A 16-inch dewatering well 220 feet deep was drilled close by before starting to sink the shaft. Continuous pumping from this well has relieved the shaft of a large proportion of the water. The combined flow from the well and shaft has fluctuated from 20 to 165 gallons per minute, with a flow of 125 gallons per minute on June 30.

Stripping was begun on the Grant Lake Reservoir in May, 1935, 3,400 cubic yards having been removed as of June 30. A diversion ditch to by-pass Rush Creek is approximately 70% completed. Headquarters for this job is the Cain Ranch camp, which has been improved and enlarged to accommodate the construction forces.

Construction on the Long Valley Reservoir project was begun early in April, 1935. The original Crooked Creek camp, constructed in 1916, has been reconditioned, enlarged, and modernized to accommodate construction crews for this project. As of June 30, the work of repairing and enlarging was 95% completed, while the new buildings were 60% completed. A sewer system was installed to take care of the sewage disposal from the mess hall, bath house, first aid station, office, and guest house; it discharges into a septic tank. Power for the Long Valley Reservoir construction is supplied from the Department's Owens Valley light and power system, over a 33 KV transmission line. A 750 KVA outdoor transformer station was installed to reduce the voltage from 33,000 to 2,300 volts for camp utilization and distribution.

Power for the Grant Lake Reservoir construction is delivered through a 4.5 mile tap off the 33 KV transmission line supplying Mono Craters tunnel. A 750 KVA outdoor transformer station was installed at Grant Lake to reduce the voltage from 33,000 to 2,300 volts.

The Department's telephone system was extended to all camps in the Mono Basin area, including Long Valley. The exchange office is located at West Portal, where switchboard connections are made to the other camps.

Plans and specifications for the Harbor Trunk Line are completed, and contract has been awarded for the purchase of 63,500 feet of 31.4 inch diameter, $\frac{3}{8}$ inch thickness, bell and spigot welded steel pipe. This line will be laid from Manchester and Western Avenues south to the Harbor District, and laying will start approximately July 5, 1935. The line will deliver Owens River aqueduct water to the Harbor District, which is now supplied by two pumping plants, one at Wilmington and the other at Lomita. These plants will be maintained as standby plants, for emergency purposes only.

The consumption of water for the fiscal year amounted to 291.2 second feet, of which 196.6 second feet, or 67.5%, was from the Owens River aqueduct source, and 94.6 second feet, or 32.5%, was from the Los Angeles River and local wells. There has been a continual decrease in all classes of consumption, which undoubtedly is attributable to economic conditions.

While the total gross operating earnings for the year just closed were \$178,014 less than for the year ending June 30, 1934, this was due primarily to decreased earnings from the sale of residential and irrigation water. However, Price, Waterhouse & Company, in their annual audit for the fiscal year 1934-35, show a net income of \$1,298,021.00 after deducting interest on the Santa Clara Valley Damage Bonds.

The rainfall during the past season was 21.66 inches, or 42% above normal. However, in the Sierra Nevada mountains, the snowfall was approximately 75% of normal. As of June 30, there were 144,180 acre feet of water stored in our reservoirs. This is the maximum amount of water impounded on this date in the entire history of the Department.

During the year, 52.2 miles of mains were laid, making a total of 3,855 miles in the system as of June 30. In this respect, I might mention that our water system is now in a better condition than at any other time during its existence, as indicated by a recent survey of the National Board of Fire Underwriters, which gave the Department a deficiency rating of 433 points, placing this city in third class of water supply, and thereby moving us up three classes since the last survey was made. This is an excellent showing, inasmuch as 200 of the points remain under 4 inch cast iron pipe. These 200 points, however, will be eliminated before long, and the water works of the City of Los Angeles will move up into a higher class in the very near future.

In conclusion, it may be stated that the Bureau has functioned in a very satisfactory manner in rendering good service to its patrons, and is at all times attempting to improve both the service and its relation to the public.

Respectfully submitted,

H. A. VAN NORMAN,
Chief Engineer and General Manager.

Major Construction Division

H. L. JACQUES, *Construction Engineer*

DURING the fiscal year ending June 30, 1935, this Division has been engaged in the following construction work:

Mono Craters Tunnel.....Hugh Mulholland, General Foreman
 Grant Lake Reservoir.....Stanley Dunham, General Construction Supt.
 Long Valley Reservoir.....S. L. Parratt, Asst. Civil Engineer.

MONO CRATERS TUNNEL

CAMPS

Construction work on this project was begun the first week in July, 1934.

Cain Ranch camp was enlarged and occupied as a base of operations until West Portal camp could be constructed, which then became headquarters camp for tunnel construction forces. Cain Ranch camp was continued as field engineering headquarters, and later was further improved and occupied also by the forces constructing Grant Lake reservoir.

In addition to West Portal camp, three other tunnel camps were constructed, one each at Shaft No. 1, Shaft No. 2, and East Portal. A summary of the buildings at these four camps is listed below.

DESCRIPTION	West Portal	Shaft No. 1	Shaft No. 2	East Portal
Mess Hall	1	1	1	1
Mess Dormitory	1	1	1	1
40-Man Dormitory	4	4	4	3
Guest House	1	.	.	.
Single Family Dwelling	5	3	2	1
Hospital	1	.	.	.
Medical Dormitory	1	.	.	.
First Aid Station	1	1	1
School	1	.	.	.
Recreation Hall	1	1	1	1
Office	1	1	1	1
Warehouse	1	1	1	1
Garage	1	1	.	.
Gas and Oil Station	1	1	1	1
Change House	1	1	1	1
Machine and Blacksmith Shop	1	1	1	1
Carpenter Shop	1	1	1	1
Tin Shop	1	.	.	.
Battery House	1	.	.	1
Compressor House	1	1	1	1
Hoist House	1	1	.
Totals	26	20	18	16

At West Portal and Shaft No. 1 all buildings are practically completed. At shaft No. 2 and East Portal buildings are 90% completed.

These are modern camps, the severe winter climate necessitating every provision for the welfare of the employees. Dormitories accommodate two men to a room, each dormitory being provided with heat, light, hot and cold water, wash room, toilets and assembly room. Butane gas is used for heating. This gas is shipped in liquid form from Los Angeles and converted into usable form by gasifying plants at each camp. Electric lighting is provided throughout all camps.

Kitchens at the four camps are electrically equipped, both for cooking and refrigeration.

Change houses are provided close to each working entrance, equipped with hot and cold showers, lockers, drying racks, etc.

At West Portal camp, a modern field hospital has been completed, having a general ward accommodating 20 persons and a smaller ward for four. There is a spacious modern surgery, a well equipped therapy and X-ray laboratory, and a diet kitchen electrically equipped. Two doctors with a corps of experienced nurses are in attendance. A fleet of three ambulances is held ready for instant service. All camps are connected by telephone with the West Portal medical headquarters. At the other three tunnel camps, first aid stations are maintained, with an experienced male nurse on duty at each place.

A recreation hall is provided at each camp, with pool tables, card tables, etc. Moving picture shows are given weekly, free of charge. Arrangements are under way to establish a library at West Portal camp for employees, books to be furnished without charge by the Los Angeles Public Library.

A school for the children of employees is maintained at West Portal. The building and equipment are furnished by the Department, the teacher and supervision being provided by Mono County.

WATER SUPPLY

For camp and construction purposes, water for West Portal and Shaft No. 1 is pumped from a spring located about 6/10 of a mile north of Grant Lake. The pump is a centrifugal, capacity 120 G. P. M., electric motor driven. There is also a standby centrifugal pump, capacity 120 G. P. M., driven by either an electric motor or a gasoline engine.

This spring water is pumped to a 408,000 gallon reservoir, covered and concrete lined, on the summit of Aeolian Hills.

Gravity pressure from the reservoir is more than ample to supply West Portal, but a booster pump (at West Portal) is necessary to deliver water to the 90,000 gallon steel tank for Shaft No. 1. This tank is located on the eastern slope of Mono Craters, from which gravity pressure supplies the camp. The booster pump (at West Portal) is a triplex, capacity 35 G. P. M., driven by either an electric motor or a gasoline engine. There is also a standby vertical centrifugal pump, capacity 70 G. P. M., electric motor driven, for use in the event of a fire at Shaft No. 1.

Water for camp and construction purposes at Shaft No. 2 is pumped from a spring located about 400 feet east of the shaft. The pump is a duplex, capacity 35 G. P. M., electric motor driven. There is also a standby triplex pump, capacity 35 G. P. M., gasoline engine driven.

These pumps deliver water to a 12,000 gallon steel tank from which gravity pressure supplies the camp.

At East Portal, water for camp and construction purposes is chlorinated and pumped from Owens river to a 24,000 gallon steel tank, from which gravity pressure supplies the camp. The pump is a centrifugal, capacity 35 G. P. M., electric motor driven. There is also a standby centrifugal pump, capacity 120 G. P. M., driven by either an electric motor or a gasoline engine.

The gasoline engine drives provided at each pumping plant are to prevent freezing in the lines, and to insure a supply of water, in the event of a serious failure in electric power service.

The total footage of water pipe serving the four camp is as follows:

	Size Inches	Length Feet
Supply Mains.....	8	12,010
	6	2,020
	5	730
	4	31,700
Distribution Lines.....	8	1,280
	6	1,440
	4	6,910
	3	3,300
	2	12,100

SEWAGE DISPOSAL

At each of the four camps, sewage disposal is through septic tanks and spreading grounds. The total footage of sewer lines laid at the four camps, including mains and branches, is as follows:

Size—Inches	Length—Feet
8	2,600
6	6,415
5	525
4	2,825

ROADS.

For construction purposes, a considerable mileage of new roads has been built. Some of these roads may be considered permanent, others temporary. The roads classed as permanent are those likely to be used later for operation and maintenance purposes. There is given below a brief description of the roads built.

	Length Miles
Permanent Roads	
From State Highway to West Portal.....	1.70
This road oil-surfaced.	
From State Highway to Shaft No. 1.....	3.80
From near Arcularius' Store (Garner's Camp) to East Portal, including a bridge across Owens river	1.60
From East Portal to Shaft No. 2.....	2.65
Total, Permanent Roads.....	9.75 Miles
Temporary Roads	
Between West Portal and Shaft No. 1.....	5.60
Between Shaft No. 1 and Shaft No. 2.....	7.20
Total, Temporary Roads.....	12.80 Miles

TUNNEL EXCAVATION, Heading No. 1 (West Portal)

A portal cut 540 feet long, containing 21,400 cubic yards of earth and 2,900 cubic yards of solid rock, was excavated to reach the portal face. Heavy snow drifts later made it necessary to construct a snow shed in this cut extending 630 feet from the portal. The 100 feet of this shed adjoining the portal is of all-metal construction, in conformity with state laws. The remainder of the shed is of timber framing with galvanized iron sides and roof.

To reach the warehouse, shops, battery house, and muck dump, a total of 2,970 feet of 24-inch gauge surface track (40-pound rail) was laid, 1,940 feet of the muck dump track being on a timber trestle ranging from 4 to 16 feet in height.

Tunnel excavation proper began September 25, 1934. The total advance to June 30, 1935, was 5,059.0 feet, of which 1879.0 feet, 37.1%, was supported. The total excavation for this period was 21,150 cubic yards, measured in place.

No water was encountered in this heading.

TUNNEL EXCAVATION, Heading No. 6 (East Portal)

Here the more abrupt surface slope necessitated comparatively little excavation to reach the portal face, and a snow shed was not required.

To provide more space for muck dump and camp buildings, the channel of Owens river was shifted for a length of 950 feet, a new channel being excavated 16.0 feet wide and 2.5 feet deep.

A total of 3,060 feet of 24-inch gauge (40-pound rail) surface track was laid to the warehouse, shops, battery house, and muck dump, 2,000 feet of the muck dump track being on a timber trestle ranging from 4 to 16 feet in height.

Tunnel excavation proper began November 23, 1934. The total advance to June 30, 1935, was 3,789.7 feet, 100% supported. The total excavation for this period was 15,540 cubic yards, measured in place.

A flow of 900 gallons per minute of water was encountered in this heading June 1. The flow has fluctuated considerably, reaching a maximum of 1,700 G.P.M., on June 13. The flow on June 30 was 1,370 G.P.M.

SUMMARY OF TUNNEL EXCAVATION

The total length of Mono Craters tunnel is 59,811.7 feet.

There has been excavated:

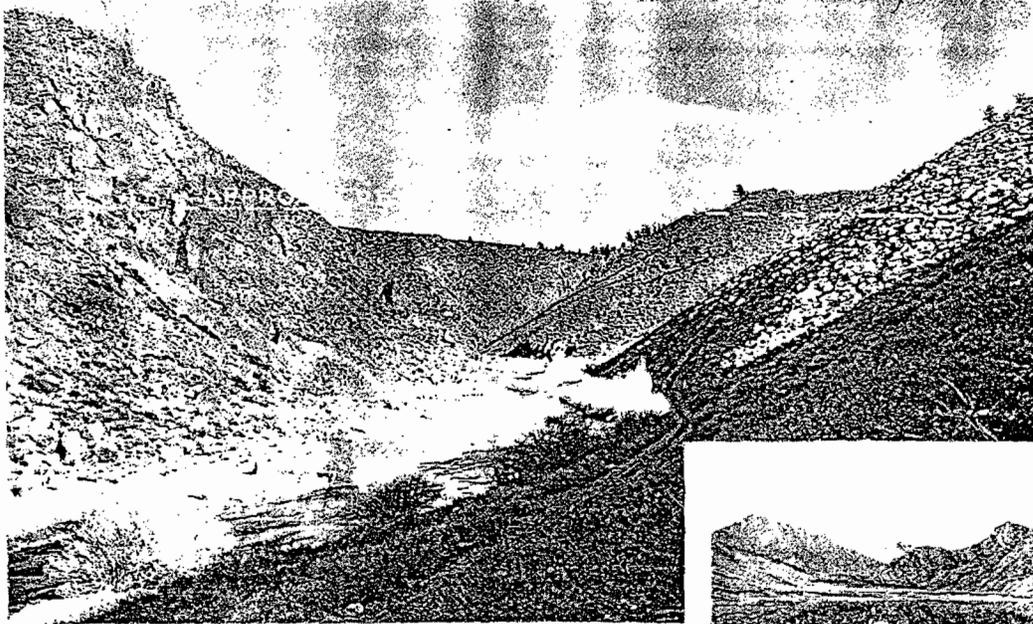
From West Portal (Heading No. 1).....	5,059.0 feet
From East Portal (Heading No. 6).....	3,789.7 feet

Total	8,848.7 feet
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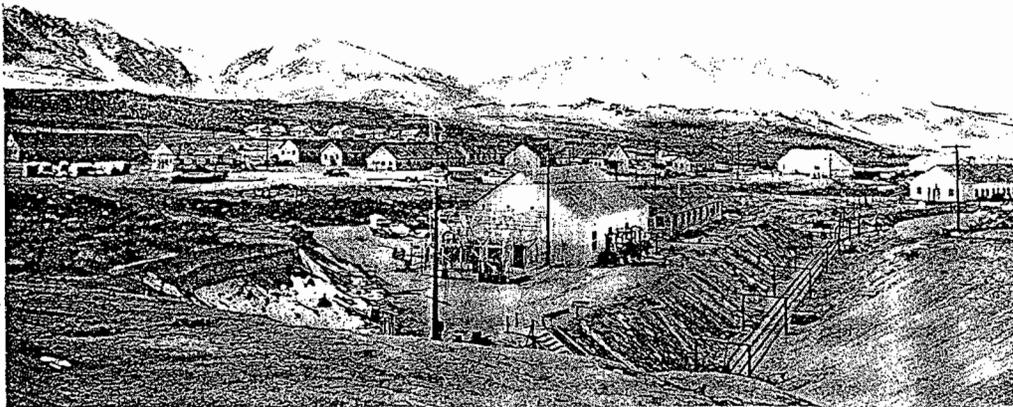
or 14.8% of the whole.

Excavation progress in both headings was slow during the early months of construction, owing to unavoidable delay in obtaining proper equipment, time required to organize efficient tunnel crews, and the severe climatic conditions.

Progress for the last three months has been good, as shown in the tabulation below. It will be noted that progress in the East Portal heading for June was slowed down, due mainly to the water encountered there.



Locations of Mono Basin development program features are shown by photographs on this page. (Above) Long Valley Reservoir damsite, looking downstream. Approximate crest of dam is indicated by dotted line. (Right, upper) Site of Grant Lake Reservoir, looking upstream. Dam under construction is approximately 1600 feet downstream from small dam shown. (Right, lower) Shaft No. 2, Mono Craters tunnel, with compressor house in foreground. To the right is portal cut as it appeared before snowshed was erected. Aeolian Hills in background and High Sierra in distance.



TUNNEL EXCAVATION PROGRESS

Month 1935	West Portal Feet	East Portal Feet
April	1011.0	1219.0
May	1045.0	1205.5
June	1201.0	571.5

SHAFT SINKING, No. 1 Shaft

Sinking was started November 28, 1934. The total required depth to bottom of muck pocket is 955.0 feet, of which 539.0 feet, or 56.4%, had been sunk June 30, 1935.

This shaft is timbered throughout. The first 40.0 feet from the collar down is concrete lined.

Sinking operations were begun with a temporary headframe and temporary hoist. The permanent headframe has been erected and in use for some months. The permanent hoist is in place June 30 and practically ready to operate.

Water was encountered in this shaft May 15 at a depth of 492.0 feet, approximately 150 gallons per minute.

SHAFT SINKING, No. 2 Shaft

Sinking was started February 9, 1935. The total required depth to bottom of muck pocket is 359.0 feet, of which 340.5 feet, or 94.8%, had been sunk June 30, 1935.

This shaft is timbered throughout. The first 70.0 feet from the collar down is concrete lined.

Sinking operations were begun with a temporary headframe and a temporary hoist. The permanent headframe has been erected and in use for some months. The permanent hoist is on the ground, the concrete foundation is completed, and this hoist should be ready to operate within a short time.

This has been a "wet" shaft for practically its entire depth. A 16-inch dewatering well, 220 feet deep, was drilled close by before starting to sink the shaft. Continuous pumping from this well has relieved the shaft of a large proportion of the water. The combined flow from well and shaft has fluctuated from 20 to 165 gallons per minute, with a flow of 125 G.P.M. on June 30.

GRANT LAKE RESERVOIR

Construction work on this project was begun in May, 1935, utilizing Cain Ranch camp for housing.

A 4" pipe line, 7,050 feet long, was laid to supplement the camp water supply, from Parker Creek.

The Mess Hall was enlarged, a single-family dwelling erected, septic tank installed, and sewers, 60% completed.

At the dam site, water pipe was laid for construction purposes, as follows:

Size Inches	Length Feet
6	1,800
3	2,700
2	3,060

The diversion ditch, to by-pass Rush creek, was approximately 70% completed, 6,650 cu. yds. being excavated.

Stripping was begun at the west end of dam site, 3,400 cu. yds. being removed.

LONG VALLEY RESERVOIR

Construction work on this project was begun early in April 1935.

CAMP

The original Crooked creek camp, constructed in 1916, was occupied and reconditioned. It was found advisable to demolish some of the buildings, owing to their state of dilapidation. The remaining buildings were repaired and renovated, and in most cases enlarged. It was necessary to construct a number of new buildings, some of which are completed and others are in process of construction.

When completed, the camp will consist of buildings listed below. As of June 30, the work of repairing and enlarging is 95% complete, while new building construction is 60% complete.

Mess Hall (175-man)	Repaired and enlarged
Mess Dormitory	Repaired and enlarged

Dormitory (65-man)	Repaired and enlarged
Guest House	Repaired and enlarged
Office	Repaired and enlarged
Garage	Repaired and enlarged
Carpenter Shop	Repaired and enlarged
Dormitory (18-man)	Repaired
Dormitory (10-man)	Repaired
Warehouse	Repaired
Rock and Gravel Plant.....	Repaired and remodeled
Dormitory (30-man)	New
Dormitory (20-man)	New
Commissary	New
First Aid Station.....	New
Bath House	New
Battery House	New
Compressor House.....	New
Blacksmith Shop	New
Plumbing Shop	New
Electric Shop	New

Electricity is used for lighting and power. Oil-burning stoves are used for heating. The kitchen is equipped with an oil-burning range, electric bake ovens, and electric refrigeration.

WATER SUPPLY

For camp use, water is obtained from a spring on the north side of Owens river about 1/2 mile below camp. Water from this spring is pumped into two 6,000-gallon steel tanks located on the south rim of Owens river gorge, from which gravity pressure supplies the camp. The pump is 3 1/2" x 4", electric motor driven.

For construction purposes, water is pumped directly from Owens river, using a gasoline driven pump, 3" x 4", Typhoon type, 100 lbs. pressure.

The footage of water pipes installed for camp and construction purposes is as follows:

Size	Length
Inches	Feet
4	210
2	3,800
1	800

SEWAGE.

Latrines have been constructed for general camp use.

Sewage disposal from the Mess Hall, Bath House, First Aid Station, Office, and Guest House is through sewers discharging into a septic tank. The footage of sewers laid is as follows:

Size	Length
Inches	Feet
6	140
4	250

ROADS.

The 4 1/2 miles of road from the State Highway to camp was widened, improved, and partially relocated to eliminate bridges over Crooked creek.

The old road through the camp was widened, improved, and extended to the adit portal of Long Valley tunnel.

Approximately 1 mile of the old road upstream along the south side of Owens river was widened and improved in order to shorten the distance between Long Valley camp and Mono Basin camps.

ROCK AND GRAVEL PLANT.

The repairing and remodeling of this plant is 70% complete.

LONG VALLEY TUNNEL AND ADIT.

Old 24" gauge track removed.....	7,360 ft.
New 24" gauge track laid.....	6,490 ft.
4" Air pipe repaired and tested.....	5,100 ft.
2" Water pipe repaired and tested.....	5,100 ft.

Work was started on trimming the unlined portion of the tunnel to conform to the Mono Craters tunnel section.

DIVERSION DITCH.

The work of cleaning and repairing the existing diversion ditch from Owens river to the tunnel portal is 75% complete.

EXPLORATION WORK.

Two test holes were drilled with Calyx rig along the upstream toe of dam site. Regular logs of these holes are on file.

Hole No.	Depth Feet
1-D	150
2-D	264
Total	414

During May and June, 1935, Dr. J. J. Jakosky, International Geophysics, made a geophysical survey of Long Valley dam site. The results of this survey are shown in a report by Dr. Jakosky, now on file with the Department. Assistance as required was extended to Dr. Jakosky in this work.

POWER TRANSMISSION LINES AND TRANSFORMER STATIONS.

Power for Mono Craters tunnel and Grant Lake reservoir construction is obtained from the 110 KV system of Southern Sierras Power Company.

The Department installed a 5,000 KVA outdoor stepdown transformer station at the Southern Sierras Power Company's Leevining Power Plant No. 3, reducing the voltage from 110,000 to 33,000 volts. From this transformer station a 33 KV transmission line, consisting of three 1/0-7 strand copper conductors strung on wood poles spaced approximately 175 feet, was constructed to West Portal and thence along the tunnel line to East Portal, total length 20.5 miles.

At each camp an outdoor stepdown transformer station was installed, reducing the voltage from 33,000 to 2,300 volts for camp utilization and distribution in the conventional manner.

The installed capacities of transformer stations at the four tunnel camps are as follows:

West Portal	750 KVA	Shaft No. 2.....	1,500 KVA
Shaft No. 1.....	1,500 KVA	East Portal	750 KVA

Power is supplied to the tunnel headings at 2,300 volts, by means of a specially designed cable. The voltage is stepped down near the working face to 440 volts, for operation of the mucking machine and other portable equipment.

Power for Grant Lake reservoir construction is delivered through a 4.5 mile tap off the 33 KV transmission line supplying Mono Craters tunnel. A 750 KVA outdoor transformer station was installed at Grant Lake to reduce the voltage from 33,000 to 2,300 volts.

Power for Long Valley reservoir construction is supplied from the Department's Owens Valley light and power system, over a 33 KV transmission line, wood pole construction, built in 1916. A 750 KVA outdoor transformer station was installed to reduce the voltage from 33,000 to 2,300 volts for camp utilization and distribution.

Lightning arresters were installed at all transformer stations.

TELEPHONE SYSTEM.

The Department's telephone system was extended to all camps in the Mono Basin area, including Long Valley. The Mono Basin exchange is located at West Portal, where switchboard connections are made to the other camps, excepting Long Valley which is reached through the Independence exchange.

A teletype installation at West Portal provides facilities for quick written communication between the West Portal, Bishop, Independence and Los Angeles offices. It serves to expedite correspondence in the many details of handling materials and equipment for construction work, and also relieves the telephone system of an overload.

In extending the telephone system to Mono Basin, the Department's existing line from Division creek power house to Big Pine, 15.6 miles, was rebuilt, using existing poles and new cross arms, with four No. 8 wires replacing the No. 10 wires formerly in use there.

From Big Pine to Cain Ranch camp (via Bishop), 79.8 miles, is new permanent construction, four No. 8 wires on treated wood poles spaced approximately 175 feet. This section of the line parallels the State Highway for a major portion of the distance.

The branch to Long Valley camp, 3.5 miles, utilizes an existing line built several years ago, which was repaired and rebuilt wherever necessary.

The branch line from the State Highway to East Portal, 5.2 miles, is new permanent construction of the same type as the main line. From East Portal to Shaft No. 2, some 2.7 miles, the extension line is of temporary construction using 4" x 6" x 18' Redwood poles.

The branch line from the State Highway to Shaft No. 1, some 4.1 miles, is also of temporary construction.

The branch line from the State Highway to West Portal, 1.7 miles, is of new permanent construction of the same type as the main line.

MONO BASIN PROJECT
MAJOR DAMS AND RESERVOIRS

GRANT LAKE DAM

Stripping operation at Grant Lake Dam site and additional exploratory work for a borrow pit and for location of the spillway were begun in May, 1935. Plans, estimates, and a construction schedule for the dam and all appurtenances, excepting the spillway, were completed and have been approved by the consulting engineers, and also by the State Engineer. Tentative designs for the spillway have been made for several different locations. The exploratory work now in progress will determine which one of these several spillway designs shall be adopted.

LONG VALLEY DAM

Preliminary investigations in connection with the proposed rockfill dam to be constructed across the Owens River Gorge at the south end of Long Valley were continued during the past fiscal year. These investigations include the preparation of tentative plans, sections and estimates for various slopes and widths of crest, and also for different types of facing for the upstream slope of the dam. Studies were made for diverting the flow of the river during the progress of construction. The data which has been gathered and prepared was submitted to the consulting engineers and geologists for their recommendations, and detailed plans are now being drawn based on these studies and the recommendations of the consulting board. When these plans are completed they will be submitted to the State Engineer for his approval.

MISCELLANEOUS STRUCTURAL ITEMS

Numerous designs, plans and estimates were completed for the camp and plant buildings to be erected in the four Mono Basin Project construction camps. These included plans and estimates for telephone, water, and sewerage systems for the camps.

Designs and plans were completed for Mono Basin Tunnel sections, track layout and switching turnouts, gate control for shaft muck dumps and for the hydraulic cylinders for operating the gates and the measuring hoppers at the tunnel shaft stations, construction of snowsheds at the tunnel portals, steel tunnel liner plates, and a tunnel bulkhead.

A tunnel pantograph was designed and constructed for use in determination of yardage of tunnel excavation. A switch was designed for the Long Valley Reservoir construction camp.

MAPS AND MISCELLANEOUS

The property maps of Mono Basin and Owens Valley were kept up to date, and property maps made for all lands to be acquired.

All Mono Basin maps that are to be filed with the Federal Power Commission were revised.

Maps were made of the Grant Lake Reservoir and watershed, and area and capacity curves made for the reservoir.

Plans were made for intake works for Mill, Leevining, Walker, and Parker Creeks.

Maps were made showing the recession of the waters of Mono Lake.

Maps showing Mono Basin Aqueduct from Grant Lake Reservoir to Long Valley Reservoir, and a map and profile of the pipe line from Leevining Creek to Grant Lake, were drawn.

A study was made for the purpose of ascertaining the cost of works for preventing waters of high boron content from flowing into the aqueduct.

RECORDS OF DISTRIBUTION SYSTEM

The following is a summary of the record work performed by the Water Drafting Division during the year:

Street Main Extension Orders checked	473
Foreman's Pipe Reports platted on District sheets and recorded	636
New Service Installation Locations given	857
New Services platted on District sheets	1757
Service Change Installations platted	9038
Street Name Changes platted	38

Mono Basin and Long Valley Field Engineering

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DURING the fiscal year ending June 30, 1935, field engineers on the Mono Basin Project were actively engaged in a variety of duties. This variety was necessitated by the beginning of construction work on the three major portions of the project: the Mono Craters Tunnel, the Long Valley Reservoir, and the Grant Lake Reservoir. The actual construction began in September, 1934, when excavation was started on the Mono Craters Tunnel.

The most important duties performed by the field engineers and surveyors during the year, were the running of precise level circuits for the control of the Mono Craters tunnel grade line, the accurate location of the tunnel's axis, and the determination of its true length.

In addition to furnishing engineering services of a precise nature for the project, the services of several field parties were constantly required for locating campsites and buildings, running traverse lines and level circuits, making road surveys from the State and County highways to the several campsites, and for general detail topographic mapping.

Survey parties and field engineers also measured and recorded the daily progress in the Mono Craters Tunnel and shafts. As the excavation progressed, pantographic cross-sections of the tunnel were made for the purpose of ascertaining the variation from the designed section and the effect of this variation on the quantity of concrete to be placed.

Test drill holes were located along the Mono Craters tunnel line and readings were taken as required to determine sub-surface water conditions. When water was encountered in the tunnel, its flow was measured and recorded.

A power line from LeeVining No. 3 plant, of the Southern Sierras Power Company, to each of the construction camps, was located and staked. The main telephone line from West Portal Camp to Crooked Creek was surveyed, together with branch lines to each of the other camps. A main water supply line from Grant Lake to West Portal Camp and Shaft No. 1 Camp was located, staked and profiled. Butane gas and sewer lines for several of the camps were located. Surveys were also made for obtaining the necessary rights of ways across government lands and private property.

In April, 1935, construction work was begun on the Long Valley dam for the storage of water in Long Valley. Included in the engineering work on this latter project, were the location of the dam and staking out of its axis, the re-establishment of the old line and grade of Tunnel No. 1 and Adit No. 1 of the original Owens River Gorge Power Project (Federal Power Commission filing July 17, 1922), the taking of cross-sections of the unfinished portions of Tunnel No. 1, and the location of some of the property lines in the vicinity of the damsite.

New topographic maps of the Long Valley damsite were completed. Construction roads to and around the proposed work were staked. Level circuits and other necessary surveys were made. Measurements were taken showing the flow of water from certain springs and wells in the area within the reservoir site.

Construction work on the Grant Lake reservoir and dam was started in May, 1935. Field engineering at Grant Lake included the establishment of control points, the location of the axis and the staking out of the dam, and a considerable amount of topographic mapping in the vicinity of the damsite. Necessary engineering work for the enlargement and improvement of the Grant Lake construction camp was also done.

Office engineering in the Mono Basin field office included triangulation adjustments, computations and plotting of traverses, preparation of plane table sheets and other computations required for field surveys. Special detailed construction drawings were prepared from time to time to facilitate the progress of the construction work on the Mono Craters tunnel.

Progress records and drawings were kept up to date and such information as required was furnished by the Los Angeles office. Drawings were made and furnished to the Southern Sierras Power Company, showing the crossings of their power lines with the telephone lines of the Department of Water and Power. Maps were drawn for the Highway Department of the State of California showing the location of construction roads leading from the main highway to each of the camps, and filing maps were made as required for obtaining various rights of ways through the Mono and Inyo National Forests.